

**MATH 151, SPRING 2010  
COMMON EXAM III - VERSION B**

LAST NAME, First name (print): \_\_\_\_\_

INSTRUCTOR: \_\_\_\_\_

SECTION NUMBER: \_\_\_\_\_

UIN: \_\_\_\_\_

SEAT NUMBER: \_\_\_\_\_

**DIRECTIONS:**

1. The use of a calculator, laptop, or computer is prohibited.
2. In Part 1 (Problems 1-12), mark the correct choice on your ScanTron using a No. 2 pencil. *For your own records, also record your choices on your exam!*
3. In Part 2 (Problems 13-17), present your solutions in the space provided. *Show all your work neatly and concisely and clearly indicate your final answer.* You will be graded not merely on the final answer, but also on the quality and correctness of the work leading up to it.
4. Be sure to *write your name, section and version letter of the exam on the ScanTron form.*

THE AGGIE CODE OF HONOR

**"An Aggie does not lie, cheat, or steal, or tolerate those who do."**

Signature: \_\_\_\_\_

1. Evaluate  $\log_{27} 9$

- (a) 3
- (b)  $\frac{3}{2}$
- (c)  $\frac{2}{3}$
- (d)  $\frac{1}{3}$
- (e) 18

2. Solve for  $x$ :  $\log_{10}(5 - x) + \log_{10}(2 - x) = 1$

- (a)  $x = 0$  and  $x = 7$
- (b)  $x = 0$  and  $x = 3$
- (c)  $x = 3$  only
- (d)  $x = 0$  only
- (e)  $x = 7$  only

3. Which of the following is equivalent to  $\cos\left(\sin^{-1}\left(\frac{x}{2}\right)\right)$ ?

- (a)  $\frac{\sqrt{4 - x^2}}{x}$
- (b)  $\frac{\sqrt{x^2 - 4}}{2}$
- (c)  $\frac{\sqrt{4 - x^2}}{2}$
- (d)  $\frac{\sqrt{x^2 - 4}}{x}$
- (e)  $\frac{2}{\sqrt{4 - x^2}}$

4. Find  $f'(1)$  if  $f(x) = \arctan(x^3)$

(a)  $\frac{3}{\sqrt{2}}$

(b)  $\frac{3}{2}$

(c)  $\frac{1}{2}$

(d)  $\frac{3}{4}$

(e)  $\frac{1}{\sqrt{2}}$

5. Find the limit:  $\lim_{x \rightarrow 1} \frac{2x^3 - 2}{x^4 - 1}$

(a)  $\frac{3}{2}$

(b)  $\frac{1}{2}$

(c)  $\frac{3}{4}$

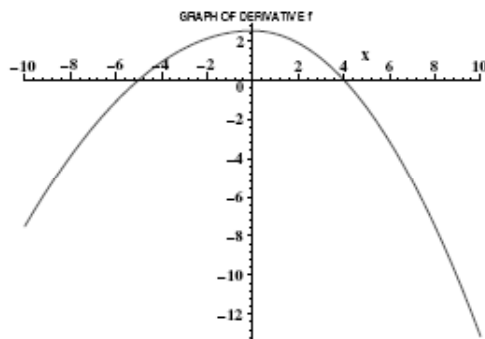
(d) 0

(e)  $\frac{2}{3}$

6. Compute  $\lim_{x \rightarrow (\pi/2)^-} \sec(x) \cos(3x)$

- (a) 0
- (b)  $\frac{1}{3}$
- (c) 3
- (d) -3
- (e)  $-\frac{1}{3}$

7. The graph of the DERIVATIVE of  $f$  is shown below. On which interval(s) is the graph of  $f$  increasing?



- (a)  $(0, \infty)$
  - (b)  $(-\infty, -5) \cup (4, \infty)$
  - (c)  $(-5, 4)$
  - (d) None of these intervals
  - (e)  $(-\infty, 0)$
8. Based on the graph of the derivative of  $f$  shown in #7, on which interval(s) is the graph of  $f$  concave up?
- (a)  $(0, \infty)$
  - (b)  $(-\infty, -5) \cup (4, \infty)$
  - (c)  $(-5, 4)$
  - (d) None of these intervals
  - (e)  $(-\infty, 0)$

9. Which of the following is the absolute maximum of the function  $f(x) = (x - 3)^3$  on the interval  $[1, 4]$ ?

- (a) 1
- (b) 27
- (c) 0
- (d)  $-8$
- (e)  $-27$

10. Which of the following is an antiderivative of  $4x^{2/3} + \frac{3}{x}$ ?

- (a)  $\frac{8}{3}x^{-1/3} + 3 \ln |x|$
- (b)  $\frac{20}{3}x^{5/3} + 3$
- (c)  $\frac{8}{3}x^{-1/3} - \frac{3}{x^2}$
- (d)  $\frac{12}{5}x^{5/3} + 3 \ln |x|$
- (e)  $\frac{12}{5}x^{5/3} + 3$

11. Find the value of  $\sum_{i=1}^4 i^2$

- (a) 19
- (b) 100
- (c) 21
- (d) 10
- (e) 30

12. Approximate the area under the graph of  $f(x) = 20 - x^2$  from  $x = -2$  to  $x = 4$  using a partition  $P = \{-2, 0, 4\}$  and taking  $x_i^*$  =left endpoint.

- (a) 112
- (b) 48
- (c) 36
- (d) 24
- (e) 56

## PART II WORK OUT

**Directions:** Present your solutions in the space provided. *Show all your work* neatly and concisely and *Box your final answer*. You will be graded not merely on the final answer, but also on the quality and correctness of the work leading up to it.

13. (10 points) Use logarithmic differentiation to find the derivative of  $f(x) = (x^{\cos x}) \cdot \sin(x)$

14. (10 points) Polonium-218 is a radioactive substance which decays exponentially. Suppose you have 1000 mg initially, and after 5 days you have 300 mg. How much Polonium-218 will you have after 10 more days (15 days total)? (Answer must be completely simplified for full credit).

15. Given the FIRST DERIVATIVE of a function is  $f'(x) = x^2e^x - 8e^x$ :

(a) (6 points) Find the intervals where THE ORIGINAL FUNCTION  $f$  is increasing or decreasing.

$f$  increasing: \_\_\_\_\_.

$f$  decreasing: \_\_\_\_\_.

(b) (3 points) Find the location of the relative extrema of  $f$ . Write NONE if none exist.

maxima at  $x =$  \_\_\_\_\_.

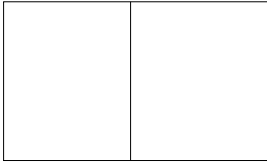
minima at  $x =$  \_\_\_\_\_.

(c) (8 points) Find the intervals where  $f$  is concave up or concave down.

concave up: \_\_\_\_\_.

concave down: \_\_\_\_\_.

16. (10 points) A farmer has 3000 feet of fencing with which to enclose a rectangular field and divide the field in half (see figure below). What dimensions of the field will maximize its area?



17. (10 points) The acceleration of a particle in the  $x$ - $y$  plane is given by  $\mathbf{a}(t) = \langle e^t + \sin t, e^t + \cos t \rangle$ . If the initial velocity is  $\langle 1, 1 \rangle$  and the initial position is the origin, find the position function  $\mathbf{r}(t)$ .

**DO NOT WRITE BELOW!**

Question	Points Awarded	Points
1-12		48
13		10
14		10
15		17
16		10
17		10
<b>TOTAL</b>		105